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AUTHOR	Papp, Raymond
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ABSTRACT

In order to identify the IS (Information Systems) skills in greatest demand in Connecticut and the New England region, classified ads for business-oriented IS positions appearing in the region's major newspapers during the summer of 1998 were analyzed. This paper highlights these findings and compares them to the skills employers from other regions have deemed important. Data are presented related to the number of ads for each city's newspaper by month, general job skills, information systems skills, education/training and years of experience, hardware platforms, operating systems, programming languages, software applications and specialized tools, and database systems. The paper also suggests curriculum implications for MIS (Management Information Systems) educators and directions for future research based on longitudinal assessment and comparison with other regions of North America. (MES)

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TECHNOLOGY SKILLS IN DEMAND: A SURVEY OF JOB ADVERTISEMENTS IN NEW ENGLAND

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T. Case

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

Raymond Papp
Central Connecticut State University

To identify the IS skills in greatest demand in Connecticut and the New England region, classified ads appearing the region's major newspapers during the summer of 1998 were analyzed. This paper highlights these findings and compares them to the skills employers from other regions have deemed important. It also suggests curriculum implications for MIS educators and directions for future research based on longitudinal assessment and comparison with other regions of North America.

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INTRODUCTION

To address the overwhelming demand for technology-literate workers in New England, a survey of major regional newspapers was taken to determine which skills were in greatest demand by employers. Students and faculty alike are aware of the insatiable demand for skilled knowledge workers with a strong background in technology concepts. The challenge faced by the faculty and curriculum committees is to assess their current course offerings to determine which skills are still applicable and which, if any, are no longer needed.

Local and regional employers in New England are having a difficult time hiring competent, skilled workers with a strong information technology background. One only needs to read the headlines of articles in newspapers like the *Hartford Courant*--"A common plea, 'Help wanted': Will a shortage of workers slow growth of state's economy?" and "The frustrating search for workers: Information technology jobs go begging in Connecticut"--to get an idea of the magnitude of the problem. Primarily due to a changing business climate, relatively high cost of living, and the loss of over 50% of graduating high school seniors to other states, Connecticut, in particular, has a difficult time finding and keeping technology workers. While it is beyond the scope of this paper to address the cost of living or migration issues, it will attempt to determine which technology skill sets are necessary and in demand by employers and how colleges and universities should respond to these needs.

Several previous studies have looked at the classified ads for trends and skills. Many recent papers have focused on other specific regions, such as the Middle Atlantic states (Jacobson and Armstrong, 1996) or the Southeastern region (Case, Price, and Rogers, 1997). It has been several years since a comprehensive study of the New England region was conducted (Athey and Plotnicki, 1992; Arnett and Litecky, 1994; Prabhakar, Litecky, and Arnett, 1995). This paper will use a methodology similar to that undertaken by Jacobson and Armstrong (1996) and Case, Price, and Rogers (1997). The focus, however, will be exclusively on the New England region.

METHODOLOGY

This study has attempted to determine which skills are in demand by employers in the greater New England region by analyzing classified ads for information systems jobs using the five largest newspapers in the region. Ads from both the actual printed classifieds as well as the Internet web sites of these newspapers were included. This is the first attempt at investigating the regional needs of New England businesses. Follow-up studies are planned for the future to determine the longitudinal implications of these skill sets. Such future surveys will attempt to replicate these findings and determine whether the changing economy in New England is reflective of the courses offered and skills taught by colleges and universities.

A pilot-study of IS job ads was conducted during April, 1998 from advertisements found in the Sunday edition of

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the *Hartford Courant*, Connecticut's largest daily newspaper. The resulting matrix of skills and competencies was used to assess several regional New England papers during the summer of 1998, thereby providing a more comprehensive assessment of IS job skills in New England.

The papers selected for this study included the Sunday edition of the *Hartford* Courant (covering greater Connecticut and Western Massachusetts), the *Boston Globe* (covering most of eastern Massachusetts, the south shore and northern New England), the *Worcester Telegram and Gazette* (covering central and western Massachusetts and northeastern Connecticut), the *Providence Journal-Bulletin* (covering Rhode Island and south eastern Connecticut), and the New England edition of *The New York Times* due to the proximity of southwestern Connecticut (Fairfield county) to New York City. For the first two months we also included the *Portland Press Herald* (covering Maine), the *Union Leader: New Hampshire Sunday News* (covering New Hampshire) and the *Rutland Tribune* (covering Vermont) in our study. These papers were dropped from the study in subsequent months due to the limited number of job postings encountered in each of these papers. Since both the *Boston Globe* and *Worcester Telegram and Gazette* advertised for more positions in these areas than the respective local papers mentioned above, the author contends that it would not compromise the study to drop these three papers from the analysis.

Analysis of Ads

Following the coding of previous studies (Jacobson and Armstrong, 1996; Case, Price, and Rogers, 1997), more than one hundred criteria were used to group several categories such as general job skills, information systems skills, programming languages, hardware platforms and operating systems, database skills, networking topologies and structures, application packages, specialized development software and educational backgrounds. The same coding methodology was employed as that used by Jacobson and Armstrong (1996).

The study was limited to ads for business-oriented IS positions placed by organizations for their own work force and to ads placed by consulting firms who hire individuals to work for them. If the advertisement was for a specific number of positions, with a particular set of skills, the need for those skills was tallied for that number. However, when the number of positions to be filled was not indicated, the skill was tallied only once (p. 45).

Thus, by using a similar classification scheme, it is possible to compare the demand for positions and skills across both cities and time periods. It also allows for replication of the study in the future and provides a means with which to compare New England to other regions. To address reliability concerns and enable comparison with earlier studies on different regions, all information systems ads were scanned and only those ads that met the criteria noted above were included. Ads for IS sales positions, teachers, and non technical personnel were not included in the survey.

RESULTS

Since the coverage of these papers sometimes overlaps, they have been analyzed with respect to geographic region rather than a specific metropolis. This provides a look at skills needed in the different regions of New England, each of which has its own industrial and technical niche. The *Hartford Courant* and the New England edition of the *New York Times* was used to assess job skills in central and western Connecticut and western Massachusetts, the *Providence Journal Bulletin* was scanned for job skills in Rhode Island and southeastern Connecticut, the *Worcester Telegram and Gazette* was used for Central and Eastern Massachusetts, and the *Boston Globe* was scanned for job skills in metro Boston and northern New England. Thus, jobs in the New England region can be attributed to one of the five papers studied.

As illustrated in Table 1, a total of 2,639 information systems advertisements appeared in the five New England papers on the first Sunday of June, July, and August 1998. The ads were analyzed using the methodology described above and the results were tabulated and analyzed using an Excel spreadsheet.

With respect to general job skills, those in the greatest demand were interpersonal and communication skills and problem solving and analytical skills. Table 2 illustratedthe percentage of ads requesting the specific skills mentioned above.

TABLE 1
NUMBER OF ADS FOR EACH CITY'S PAPER BY MONTH

	The Hartford Courant (CT)	New York Times (NY)	Providence Journal Bulletin (RI)	Worcester Telegram & Gazette (MA)	The Boston Globe (MA)	New England Region **Totals**
May	142	344	34	27	174	721
June	128	296	22	18	136	600
July	139	327	41	22	157	686
August	109	353	28	13	129	632
Totals	518	1320	125	80	596	**2639**

TABLE 2
GENERAL JOB SKILLS

	Connecticut & Western Mass (includes NYC)	Central & Eastern Massachusetts	Rhode Island	Metro Boston & Northern New England	New England Region Average
Coordination & Project Management	8%	9%	7%	10%	8.5%
Interpersonal & Communication Skills	10%	12%	9%	11%	10.5%
Problem Solving & Analytical skills	9%	8%	10%	13%	10%
General Job Skills	6%	5%	4%	6%	5.25%

TABLE 3
INFORMATION SYSTEMS SKILLS

	Connecticut & Western Mass (includes NYC)	Central & Eastern Massachusetts	Rhode Island	Metro Boston & Northern New England	New England Region Average
Design & Development	6%	8%	7%	9%	7.5%
Y2K (Year 2000)	3%	4%	3%	3%	3.25%
Hardware & Software Implementation	5%	5%	4%	6%	5%
Networking & Telecommunications	9%	6%	10%	10%	8.75%
Operations & Maintenance Skills	5%	4%	5%	4%	4.5%

The information skills in greatest demand were design and development and networking and telecommunications. This is in line with previous studies of other regions. The demand for networking and telecommunications is probably due largely to recent developments in Internet technologies and the availability of database programs for the P.C. Surprisingly, there was little mention of Y2K (Year 2000) skills. This might indicate that employers are looking for specific skill sets rather than general Y2K knowledge. Table 3 delineates the most common IS skills. As expected, the educational background requested by most employers was that of a bachelor's degree. This

is in line with previous studies of other regions (Case, Price, and Rogers, 1997; Jacobson and Armstrong, 1996; Prabhakar, Litecky, and Arnett, 1995). There was also a demand for employees with advanced degrees, probably due to the New England region's large number of college graduates and college educated employees. Professional certifications were mentioned quite often, particularly Microsoft's MSCE and Novell's CNE. Less than 5% of the jobs required more than 5 year's of experience. This is probably due to the nature of classified advertisements--more entry-level jobs are placed in print media. Table 4 breaks down the education and training requirements.

The hardware platform in greatest demand was that of the PC. This was followed closely by mainframe systems and mini- and mid-range systems. This appears to reflect a nationwide trend in migration toward PC and client/server systems and away from mainframe and minicomputers. The greater demand for mainframe systems skills over the Southeastern U.S. (Case, Price, and Rogers, 1997) is probably the result of more insurance and financial firms headquartered in New England and their reliance on older platforms. In fact, many of these firms continue to employ mainframe and midrange systems and are just beginning to migrate to client-server and PC-based platforms. Table 5 illustrates the hardware platform requirements.

Windows NT was the operating system mentioned the most often, followed closely by Windows 95 and Windows 98 and UNIX. There is a definite trend toward PC based operating systems and away from mainframe systems as shown in Table 6. Interestingly, DOS was still mentioned 5% of the time and DCL (used on Digital minicomputers) was in greater demand in Central and Eastern Massachusetts and Northern New England, presumably due to Digital's strong presence in New Hampshire.

TABLE 4
EDUCATIONAL/TRAINING AND YEARS OF EXPERIENCE

	Connecticut & Western Mass (includes NYC)	Central & Eastern Massachusetts	Rhode Island	Metro Boston & Northern New England	New England Region Average
MSCE/CNE/CNA	14%	9%	3%	10%	9.25%
Bachelor's Degree	33%	20%	24%	28%	26.25%
Advanced Degree	4%	3%	2%	4%	3.25%
1-2 Years Experience	17%	15%	18%	22%	18%
3-5 Years Experience	19%	18%	13%	18%	17%
5 + Years Experience	5%	6%	4%	5%	5%

TABLE 5
HARDWARE PLATFORMS

	Connecticut & Western Mass (includes NYC)	Central & Eastern Massachusetts	Rhode Island	Metro Boston & Northern New England	New England Region Average
Personal Computers	28%	25%	20%	30%	25.75%
Client/Server systems	10%	13%	15%	14%	13%
Mini- & Mid-range	12%	10%	7%	15%	11%
Mainframe systems	17%	18%	12%	15%	15.5%

TABLE 6
OPERATING SYSTEMS

	Connecticut & Western Mass (includes NYC)	Central & Eastern Massachusetts	Rhode Island	Metro Boston & Northern New England	New England Region Average
Windows NT	18%	15%	12%	17%	15.5%
Windows 3.x/95/98	11%	11%	10%	9%	10.25%
UNIX	11%	10%	8%	14%	10.75%
AS/400	7%	2%	1%	3%	3.25%
Novell NetWare	10%	5%	4%	6%	6.25%
JCL/MVS	2%	3%	2%	5%	3%
DCL	2%	5%	1%	7%	3.75%
DOS	4%	5%	4%	6%	4.75%

The programming languages most in demand were COBOL, C++, and Visual Basic. COBOL was in greatest demand in Connecticut and Rhode Island and C++ was most often requested in Central and Eastern Massachusetts, Metro Boston and northern New England. This is probably due to the need for Y2K compliance issues and the large number of insurance firms in Connecticut which employ older legacy systems. Overall, the New England region is in line with the Southeastern U.S. (Case, Price, and Rogers, 1997) and in the Middle Atlantic states (Jacobson and Armstrong, 1996) with respect to programming languages. While the order of importance may vary slightly, it appears that demand for non object-oriented programming languages is the result of maintenance on legacy systems and the demand for visual programming languages (i.e. Visual Basic and C++) reflects the focus on new development in a GUI environment. Table 7 illustrates the breakdown by language.

Specialized application package needs varied by sub-region. This is also not surprising given the different types of business found in each area. The applications consistently in greatest demand were MS Office 95/97, Powerbuilder, and CICS. There was more of a demand for CICS in Connecticut and Central Massachusetts, probably as a result of larger numbers of insurance and financial firms in the area.

Database skills made up a large percentage of the total number of ads. Among the specific systems mentioned, Oracle was first, followed by DB2, Sybase, and Access. This appears to be a national trend as ads from the Southeastern U.S. (Case, Price, and Rogers, 1997) and the Mid-Atlantic states (Jacobson and Armstrong, 1996) also demand these skills. It appears that Oracle and Access are used in PC-based development and Sybase and DB2 are used primarily in mainframe systems. Table 11 illustrates the needs for particular database skills.

TABLE 7
PROGRAMMING LANGUAGES

	Connecticut & Western Mass (includes NYC)	Central & Eastern Massachusetts	Rhode Island	Metro Boston & Northern New England	New England Region Average
C	11%	10%	2%	14%	9.25%
C++	13%	15%	7%	18%	13.25%
COBOL	15%	14%	21%	14%	16%
JAVA	7%	4%	4%	5%	5%
HTML/VRML	2%	2%	4%	4%	3%
VISUAL BASIC	12%	10%	7%	14%	10.75%

TABLE 8
SOFTWARE APPLICATIONS & SPECIALIZED TOOLS

	Connecticut & Western Mass (includes NYC)	Central & Eastern Massachusetts	Rhode Island	Metro Boston & Northern New England	New England Region Average
CICS	12%	11%	1%	3%	6.75%
Lotus Notes	3%	2%	1%	2%	2%
MS Office 95/97	9%	12%	11%	8%	10%
MS Exchange	1%	1%	2%	2%	1.5%
Smartsuite	1%	0%	0%	1%	0.5%
Powerbuilder	7%	8%	6%	6%	6.75%
COBRA	4%	2%	0%	4%	2.5%

TABLE 9
DATABASE SYSTEMS

	Connecticut & Western Mass (includes NYC)	Central & Eastern Massachusetts	Rhode Island	Metro Boston & Northern New England	New England Region Average
Access	9%	10%	7%	4%	7.5%
dBase	2%	3%	0%	1%	1.5%
DB2	13%	12%	3%	8%	9%
FoxPro	5%	3%	2%	2%	3%
IMS	4%	5%	1%	1%	2.75%
Oracle	16%	14%	14%	15%	14.75%
Sybase	9%	8%	5%	10%	8%

DISCUSSION

Comparing the results of jobs available the New England region with that of the Middle Atlantic states (Jacobson and Armstrong, 1996) and the Southeastern U.S. (Case, Price, and Rogers, 1997), some interesting similarities and disparities surface. With respect to basic business skills, many employers sought coordination & project management ability, strong interpersonal & communication skills, and problem solving & analytical competence. This supports findings from the other regions. Basic skills are a necessary co-requisite for a position in information systems.

The operating systems in greatest demand in New England are Windows NT, followed by Windows 3.x/95/98 and Unix. This differs slightly from the Mid-Atlantic states where a greater demand for UNIX exists than for Windows NT (Jacobson and Armstrong, 1996). The percentages for New England are much more closely in line with that of the Southeastern U.S. (Case, Price, and Rogers, 1997), perhaps suggesting that different industries (i.e. insurance and finance in New England and the Southeast compared to government and public service in the Mid-Atlantic) may have unique needs.

The movement toward PC and client/server based computing is evident by the greater number of ads requesting these skills. This also appears to be a national trend as firms begin to move programs and data from mainframe systems to a more distributed environment. Mainframe skills continue to be in demand in New England more so than in other regions. This may be the result of a larger number of insurance and finance firms that still employ legacy applications written for the mainframe. The movement away from such systems is evident, albeit at a slower pace than other areas of the country.

Greater reliance on mainframe systems may also explain the dominance of COBOL for programming in New England. While COBOL is also requested in other parts of the country, many students from Connecticut take positions in the local insurance companies as COBOL maintenance programmers. New development, like other areas of the country, appears to be in the visual programming languages like C++ and Visual Basic. There is also increasing demand for C and JAVA, indicating a movement toward web-based development.

Like other parts of the country, database skills continue to be in great demand in New England as well. The primary skill set is Oracle, which is also the most often requested in other areas of the country (Jacobson and Armstrong, 1996, Case, Price, and Rogers, 1997). However, unlike the other regions, DB2 and Sybase are the next most demanded database language in New England. Again, this may be explained by the large number of firms still using mainframe systems. The rest of the findings are consistent with those reported by Jacobson and Armstrong (1996) and Case, Price, and Rogers (1997).

Curriculum Implications

Comparing the needs IS employers in New England have requested with what the students have been taught provides a strong impetus to assess the current curriculum. According to recent MIS graduates in Connecticut, Connecticut State University (CSU) seems to be doing well in preparing students for the working world. There is, however, a need to for greater emphasis on business skills, especially oral, written, and presentation skills. This is supported by employers as they have requested these "soft" skills as co-requisites to the "technical" skills. With respect to the "hard" skills, students felt prepared in networking, systems analysis, and database theory. The expressed a need to learn specific skills such as Oracle, Powerbuilder, C++, and Microsoft certification. This presents a dilemma for MIS educators. Do we teach the latest hot skills or do we teach concepts that students can adapt to changing requirements and technologies? This author concurs with Case, Price, and Rogers (1997), who suggest that universities must emphasize lifelong learning and students should be provided with a strong conceptual foundation with which they can acquire and adapt to new skill sets to meet changing business needs.

Employers in Connecticut face many of the same needs as other areas of the country. Students in MIS are few and jobs are plentiful. Unfortunately, while a large portion of CSU graduates live and work within a 40-mile radius of Hartford and the campus, an increasing number a choosing to take positions outside Connecticut and even New England. The national demand for information systems skills might shed some light on why Connecticut, despite a strong technological economy and excellent educational system, continues to lose IS graduates to other cities and states. As educators, we must do our part to assist students in the learning process and prepare them for the dynamic global business environment.

Future Research

Over the past few years, three distinct regions of the U.S. have been analyzed with respect to information systems job skills and employer needs. The next logical steps are two-fold. Analysis of other areas of the country (e.g. the Midwest, the West coast, the Pacific Northwest) is needed to yield comparisons across North America. Longitudinal studies should also be conducted in the coming years to determine whether the analyses reported herein are long-term trends or short-term needs. By tracking information skills over time, it will be possible to forecast which skills will likely be needed in the near future, which are in current demand, and also which skills are quickly falling out of favor among employers. Such research will assist universities in development of local courses as well as national MIS curricula (Gorgone, and Gray, 1998) to meet the dynamic needs of employers and employees as we prepare to enter the next millenium.

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